VOLKSWAGEN

GROUP OF AMERICA

The Honorable Ajit Pai
Chairman
Federal Communications Commission
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Date

Subject: In the matter of GN Docket No. 18-122

Honorable Chairman Pai,

On behalf of Volkswagen Group of America (VWGoA), I would like thank you for the opportunity to comment in the matter of GN Docket No 18-122. If you have any questions, require additional data or further clarification, please feel free to contact me or any of our team members listed below.

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Sincerely,
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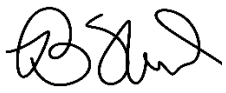

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Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, DC 20554

In the Matter of	**)**	
	)	
Expanding Flexible Use of the 3.7 to 4.2 GHz Band	**)**	**GN Docket No. 18-122**

REPLY COMMENTS OF Volkswagen Group of America

We welcome this opportunity to respond to comments filed regarding various proposals contained in the July 2018 NPRM in the above-captioned proceeding, for release of frequencies in the range of 3.7 – 4.2 GHz and transitioning to more efficient flexible use of spectrum by both fixed and mobile wireless applications at industrial manufacturing facilities, while protecting incumbent C-Band satellite earth stations and commercial mobile carriers from interference.

The Volkswagen Group in the United States encompasses marketing, sales, and financial services for Volkswagen motor vehicles, as well as manufacturing operations in Tennessee, technology offices in California and Michigan and a strategic design consultancy, all contributing to the vibrancy of the American automotive industry. Innovation and growth in the industry increasingly depends on the availability of advanced on-site, localized connectivity at manufacturing facilities, utilizing 5G wireless technologies. To this end, we support the market-based approach suggested by the Commission at paragraph 66 of its Notice, for transitioning incumbents from portions of the 3.7-4.2 GHz band.

The Commission suggests authorizing Fixed Satellite Service (FSS) to voluntarily clear this spectrum in exchange for compensation from terrestrial users in a secondary market. This approach could free up spectrum for 5G much more quickly than an auction process would.

Further, we applaud the Comments of Bosch and Supporting Parties, which have proposed implementation of localized, 5G private networks to support next-generation manufacturing and the Industrial Internet of Things (IIoT), noting that 5G will become the 'central nervous system" of entire factories.

I. The Need for 3.7 to 3.8 GHz Frequencies and More in U.S. Manufacturing

The vast majority of commenters in this proceeding are incumbent commercial mobile carriers, broadcast media entities, and FSS providers who understandably seek to extend or preserve their control of this frequency band for their own use. The economic interests of American manufacturing entities in using the band for localized 5G private networks to support next-generation automated production systems has received too little attention. In fact, the manufacturing sector will benefit most from a robust combination of commercial 5G services and customized private networks to meet specialized local needs.

The reality is that smart manufacturing will increasingly require suitable frequencies to support a reliable communications layer for controlling and integrating modern processes and equipment. However, certain technical requirements regarding minimum latency and maximum upload speeds, for example, and other safety, security and legal requirements, simply cannot be met by commercial wireless service operators. So manufacturers will need to manage their own 5G local networks much like they do their use of wireless networks today.

The provision of the higher sub-range 3700 – 3800 MHz for regional allocation through a licensing application process would be particularly welcomed. The typically dense object utilization and cultivation within production areas (including safety guards, guide tracks, etc.) makes the propagation capacity of the band 3700 through 3800 MHz appear predestined for use with 5G technology by automotive manufacturers. This band provides an opportunity to lay the foundation for Industry 4.0 manufacturing because it can support the low latency and high-density connections required to perfectly synchronize components of automated production. Investments in production facilities require reliability in long-term planning, which should be another consideration in the FCC spectrum allocation rulemaking process.

Utilization of the range 3700 through 3800 MHz would represent a good first step toward achieving an agile production environment with growing wireless connection needs. Of course, this frequency band can meet only a portion of the need for long-term spectrum solutions. Another good place to start is the 3600 through 3700 MHz range because these frequencies have already been approved by Germany and

other countries for 5G applications, and international co-ordination on frequency allocation is helpful to all, including American competitiveness.

As a secondary matter, we also welcome the possibility of utilizing additional frequencies in the 3.6 GHz range by 2020, as agreed upon by EU lawmakers in March 2018. The possibility of local utilization of unused frequencies in the 3400 through 3700 MHz band offers a good approach to maximizing innovation opportunities. We support proposals for localized sharing of band 3400 through 3700 MHz that fosters innovation. The propagation capabilities of these frequencies allow for great spatial physical separation and isolation of uses within discrete industry sectors.

We support auctions and a bidding process for frequency user rights for the nationwide ranges 1920 through 1980 MHz and 2110 through 2170 MHz for prompt provisioning of advanced mobile broadband services. Nationwide availability of these services is of critical importance to automotive innovation in self-driving vehicles and safety systems. Within the boundaries of technical viability, and given cost efficiency and profitability, ubiquitous coverage for these services is the ideal. Development of additional communication sectors and ranges is expected both in production environments and in the area of vehicle communication, as well as linking on the device level with surrounding civic IoT transportation systems and 'smart cities' through 5G technology.

II. The Specific Needs of the Automotive Sector

The automotive industry of the future has clear and concrete needs for wireless connectivity both in its manufacturing facilities and for the safe operation of both currently connected cars and autonomous vehicles. In terms of manufacturing, we need to create a production environment that's as efficient and economical as possible, leveraging Industry 4.0 applications for extremely flexible vehicle production processes.

Every vehicle which is manufactured must receive in the course of the production sequence the specific necessary software.

- The amount of data transfer which is required is approximately 50 GB in 20 minutes. That is a download rate of 330 Mbit/s.
- At one vehicle produced every 90 seconds, 14 vehicles must be simultaneously in the data flashing process, which translates to a required throughput of 4.6 Gbit/s.

- Parallel to that process, a data upload of approximately 10 GB occurs which adds another 925 Mbit/s of required bandwidth.
- In order to allow real-time diagnosis of the systems during vehicle production, a round trip latency of no greater than 50ms must be ensured.

For the reasons above, it is necessary to reserve a sufficiently great amount of frequency spectrum per vehicle.

Processes require the use of fully mobile and flexible systems and equipment on a technical level. These current production systems are hardwired with cabling that is very cumbersome. For example, grippers and actuators mounted on industrial robots are currently connected via costly cables, even though invisible wireless connections would be far superior in every way. Therefore, the introduction of suitable radio-based technology is essential to achieve mission-critical flexibility and remove the physical limitations of wires.

The automated technology of our production systems lacks an appropriate embedded radio technology that could meet the needs of real time transmission, reliability, availability, and flexibility, as well as service quality. Even the smallest discrepancy in communication can cause production stops and/or safety risks. Personal injury and potentially huge economic damages can result from communication lapses and production downtime.

Production environments include a diverse array of technologies with data connections. A vehicle manufacturing campus requires availability of high bandwidth so that several thousand robots can communicate with each other and with their human managers in real time with low latency, including the use of video applications. Synchronicity must be instantaneous. Many applications cannot be run serially, but must operate in parallel, for example on five separate bands of 20 MHz each.

Unfortunately, investment in the development of radio-based solutions for the automotive industry is stagnating due to the lack of planning reliability regarding basic resources like frequencies. The innovation capabilities of the automotive industry in particular could get a boost from allocation of New Radio (NR) frequency band FR1 (with 100MHz max bandwidth) in the range under 6 GHz, which is a part of the air interface defined by 3GPP for 5G.

However, Volkswagen is also very interested in NR FR2 (mmWave) that has a 400 MHz maximum bandwidth and two channel aggregation in the frequency range 24-86 GHz. The main advantage of higher

frequencies in the 24 -86 GHz band are throughput and bandwidth, but we understand they are not a part of the instant proceeding.

An additional need for 5G technology in the automotive industry is related to allocation of spectrum below 1GHz for mobile communication among smart vehicles and between vehicles and their environment, and represents another critically important matter. Many telecom regulators do not take the allocation of this frequency range into consideration. We want to emphasize that from the perspective of the automotive industry, the spectrum below 1 GHz is absolutely necessary for future IoT applications in the area of cooperative autonomous driving.

III. Technical Considerations Supporting the Use of Mid-band Frequencies at Automotive Manufacturing Sites

Many factors contribute to the need for allocation of the frequency range 3700 – 3800 MHz for use at our production sites. The framework conditions for the allocation of wireless connectivity frequencies for vehicle production sites deviate greatly from the large-scale demand allocations for mobile broadband services across broad geographies that form the core business of mobile network service providers.

The local wireless network at production sites must be independent of broadband services provided by mobile network service providers. Control of a closed wireless network must be kept separate for both proprietary business and liability reasons.

It is not appropriate to link the services of commercial mobile network service providers with the localized connectivity required by Industry 4.0. Otherwise, automotive production and other manufacturing operations would be directly affected in case of network outages or capacity bottlenecks. In the normal course of business, moreover, commercial mobile providers do not prioritize service to factories in remote locations while configuring their networks. This is another reason why the automotive manufacturing industry must be able to prioritize on-campus wireless capacity for its own purposes.

Production sites are centrally planned and duplicated for international locations. There is no mobile network provider that can offer worldwide service level agreements (SLAs) that are economically acceptable and would also meet technical requirements.

The startup mentality of Silicon Valley showed that the "Quick Win" isn't always the right path. Gradual assembly of building blocks in the context of a stable legal and regulatory framework can prove to be a much more successful approach. Today's connected technology leaders need appropriate framework conditions in FCC wireless rules in order to design and deploy underlying communications innovation for smart manufacturing processes.

Neither licensed or unlicensed frequency allocations for on-campus IIoT utilization of Industry 4.0 applications would compromise or affect current wireless users because: 1) technical measures can be mandated that will limit frequency utilization to confined areas, 2) there is no overlap of currently offered mobile services with the requirements for Industry 4.0 services, and 3) commercial mobile wireless network service providers can still function concurrently as service providers for the mobile needs of the same enterprise customers.

We are committed to contributing our technical expertise to the ongoing fine-tuning of the frequency allocation process in the U.S. to better support smart manufacturing and economic growth. As an engineering leader in the automotive industry, we have clearly identified and demonstrated the demand for and potential of 5G for industrial technologies. Therefore, Volkswagen requests that the Commission expand flexible use of the 3.7 – 3.8 GHz band to facilitate the development of private 5G local networks for Industry 4.0 applications. We hope to begin an open dialogue with the Commission about how to optimize this potential for applied innovation using wireless technology. With the Commission's help, the automotive industry can become a trailblazer in deployment of 5G as a steppingstone to Industry 4.0 in the United States.

Respectfully submitted,

Volkswagen Group of America

December 11, 2018